ZIRKONIUM, SPATDIF, AND MEDIAARTBASE.DE; AN ARCHIVING STRATEGY FOR SPATIAL MUSIC AT ZKM

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ABSTRACT

ZKM | Institute for Music and Acoustics has been contributing to the production and realization of spatial music for more than 20 years. This paper introduces how the institute archives the spatial compositions, maximizing the universality, reusability, and accesibility for performances and research in the future by combining three key elements: Zirkonium, SpatDIF, and mediaartbase.de.

1. INTRODUCTION

1.1 IMA

The Institute for Music and Acoustics (IMA) at the Center for Art and Media (ZKM) in Karlsruhe is dedicated to electroacoustic music. One of the main focuses of the IMA is the creation of new electroacoustic compositions as well as their presentation. For this purpose the IMA conducts a guest artist program, where we invite on average about 30 composers per year to work in one of our ateliers. Such a residency normally lasts one to three months and the result is typically a new electroacoustic composition. In the course of more than 25 years of the institute's activity since 1989, several hundred pieces have been composed. Thus, it is obvious that a strong archiving strategy is very important for us, which led us to the *mediaartbase.de* project described in section 3.3.

The pieces composed at IMA cover various kinds of electroacoustic and computer music, including live electronics and fixed-media pieces. Already from the very beginning of IMA in 1989, most of the new compositions were multichannel pieces, often for the widely-used quadraphonic or 8-channel circle of loudspeakers. This fact is reflected by our atelier infrastructure – most of our ateliers are equipped with four or eight loudspeakers.

In 2006, we introduced the *Klangdom* ("Sound Dome"), which can be considered as a quite natural extension and successor of the quadraphonic and 8-channel circles. It is a speaker configuration in the form of a large hemisphere surrounding the audience [1]. Our main Klangdom is installed in the ZKM_Cube, which is the IMA's main concert space. In order to facilitate the control of the Klangdom we developed the software *Zirkonium*. It allows the composer to spatialize sounds by placing them onto the hemisphere of speakers and by moving them arbitrarily between speakers. Zirkonium will be discussed in more detail in section 3.1. Today, more and more composers decide to create pieces for the Klangdom. Therefore, it is inevitable to ponder the archiving strategies of this kind of spatialized music. This paper focuses on the fixed-media pieces composed for the Klangdom and their archiving issues. Some parts of the discussed problems may apply to a broader range of electroacoustic compositions.

1.2 Objectives of archiving at IMA

Concerning the target audience of our archive at the IMA, we may distinguish three different scenarios.

- Preservation, long-term availability: the archived compositions should be preserved as long as possible.
- Application, short-term availability: The archived compositions should be available in a format which is ready to be played by current spatial audio systems. In other words, a composition can be copied from our archive and can immediately be played on our concert system, without the need of any cumbersome and error-prone format conversion. This is quite important for our everyday commodities within the IMA.
- Accessibility: the archived compositions should be accessible for the general public as well as for researchers and scholars who are interested in them.

2. ISSUES

2.1 Object-based vs. channel-based audio

2.1.1 Number of speakers

The mentioned transition from quadraphonic or 8-channel circles to the Klangdom and Zirkonium went along with the transition from so-called channel-based audio to object-based audio. In channel-based audio all spatial information is contained in the audio data, while in object-based audio the audio data is accompanied by separate meta data which defines the spatial behavior of the audio [2]. A consequence of this difference is, that in channel-based systems the speaker layout is predetermined and cannot be changed, while in object-based systems the number of speaker channels is flexible. The actual number and position of speakers in object-based systems is known by the software which renders the movements of the audio at run-time. Consequently, the number of speakers is not a relevant information for the archiving of Klangdom pieces, while it is obviously an essential information for the archiving of channel-based pieces.

2.1.2 Scores

The meta data which defines the spatial behavior of the audio data can be received by the renderer in different ways. In Zirkonium there are basically two ways. One way is via the OSC protocol, which is frequently utilized for live applications. The other way is via a spatialization score, which is the preferred way for fixed-media pieces. In order to create a score, the composer can use Zirkonium's *Trajectory editor*, where he can graphically draw the paths along which the audio should travel. Until recently Zirkonium used its own XML format for the score. The newest version of Zirkonium, version 3.2, offers a functionality to export more universal *SpatDIF* version 0.4-compliant XML. SpatDIF is discussed in more detail in section 3.2.

2.1.3 Documentation

A significant advantage of spatial score is that the score represents a documentation of the audio movements. This can be extremely helpful for researchers, when it comes to the analysis of the spatial characteristics of a composition. And since researchers are among the main target users of our archive, object-based pieces are in this sense better suited for the archive than channel-based pieces. Obviously, the score of spatial notation is beneficial not only for the researcher, but also for the composer himself, because it makes it easier to revisit and revise old pieces or reuse materials for new pieces.

There are different degrees of abstraction as to how a movement can be described in the score. The higher the level of abstraction, the better it accommodates the analysis of the spatial characteristics of the composition. In a high level of abstraction, an instruction might be similar to the following: "audio object xy should be cycling clockwise for xy seconds with xy angular velocity." In a lower level of abstraction the same movement might be described by a series of discrete breakpoints.

2.1.4 Advantages of channel-based audio

There are also advantages of channel-based audio compared with object-based audio. The main advantage is its simplicity. It requires neither a score nor an application, which would interpret and render the score. The knowledge of the speaker position is sufficient in order to play the piece using any DAW software, any computer platform or even just a tape machine. For Zirkonium pieces, on the contrary, the performer still needs the Zirkonium software, a Mac computer with a compatible operating system, a compatible audio interface, etc. In this sense object-based pieces are less suited for long-term archiving – which on the other hand is one of our main archiving objectives. In order to overcome this disadvantage, it is necessary to establish a standard for the spatialization score, which is the aim of SpatDIF. Zirkonium changed its score format to be SpatDIF compliant in order to support this endeavor.

2.1.5 Exporting Zirkonium pieces

Object-based pieces can be converted to channel-based pieces by simply recording the audio signal which is being sent to the speakers. In this way, we could retrieve a channel-based version of a Klangdom piece which matches exactly the speaker layout of the Klangdom in the ZKM_Cube. One might call this a "bounced" version of the Zirkonium piece. This channel-based version would then have all the advantages and disadvantages of any other channel-based piece. We use this method mainly with Klangdom pieces which have been created with other software than Zirkonium, because in these cases we do not have influence on the software development and thus we cannot be sure about the future availability of the software.

Strictly speaking a channel-based version can only be played on a speaker setup which matches exactly the original setup. Nonetheless there is a workaround for Klangdom setups which differ in their number of speakers: The original speakers are placed as virtual speakers onto the actual target Klangdom. It might cause a loss of spatial resolution either compared to the original piece (if the original Klangdom comprises more speakers than the actual Klangdom) or compared to the potential of the actual Klangdom layout (if the actual Klangdom comprises more speakers than the original one). Nevertheless it seems to be a reasonable way to treat Klangdom pieces, if there is no object-based, but only a channel-based version available.

2.2 Audio file format

A detailed discussion about the audio file format appropriate for archiving would exceed the scope of this paper. We want to mention only a few issues which we faced in the context of Klangdom pieces.

The main issue was that different major versions of Zirkonium needed different audio file formats. The first, "classic" Zirkonium, released in 2006, was able to playback only a limited numbers of mono sound files, because it produced drop-outs during the file reading process. The solution was to pack ideally all audio sources in one monolithic interleaved file, containing up to 32 channels, which used to be the maximum number of channels "classical" Zirkonium could afford to process. A piece with 32 source channels, 48 kHz sampling rate, 24 bit sample depth and a duration of 20 minutes would require a file size of more than 5 GB. This was beyond the limit of 4 GB, set by the commonly used WAV or AIFF file formats. Therefore, the recommended file format for classic Zirkonium pieces was the Core Audio Format (CAF) [3], released by Apple in 2005.

Zirkonium version 2, released in 2014, replaced the CoreAudio-based audio engine of "classical" Zirkonium by Max/MSP and employs sfplay~objects for playback. However, sfplay~is unable to play CAF files. The recommended file format for Zirkonium version 2 pieces was 8-channel WAV format, using several audio files, if more than eight source channels were needed. The conclusion drawn from these audio file format issues is, that for short-term availability the file formats in the archive might have to be changed from time to time.

Concerning long-term availability, we tend to consider a collection of mono files as the most secure way of archiving, because in that way the channel assignment remains stable even if parts of a file get corrupted or lost. Therefore, we have to archive a piece in different versions for short-term and long-term availability.

Another issue is the sampling rate. We try to avoid changing the sampling rate during a concert. Most concerts are run in 48 kHz, but there are also concerts in 44.1 kHz. Given our archiving objective of short-time availability as described above, this means that we should keep two versions of each Klangdom piece in the archive, one for each sampling rate. The problem arises that easily large amounts of data accumulate and have to be held available. This is especially true if variants for different major versions of Zirkonium should be available as well as bounces for different Klangdom setups.

2.3 ZirkOSC

There is a special group of Klangdom pieces in which the spatialization data is not stored in a Zirkonium file, but in a DAW session file as automation data. In these pieces, the Zirkonium-Renderer is remote-controlled via OSC messages sent from the DAW plugin *ZirkOSC*. ZirkOSC is a separate software being developed since 2012 by the Groupe de Recherche en Immersion Spatiale (G.R.I.S.) at Université de Montréal under the direction of Robert Normandeau [4]. A similar approach is taken by the ToscA plugin developed by IRCAM in 2014 to control IRCAM's Spat software [5]. The advantage of ZirkOSC or ToscA is their seamless integration into the DAW workflow. The disadvantage is that the automation data is tightly bound to the actual DAW software and it is difficult, if not impossible, for the archive to provide long-term availability.

There are two solutions for this problem. One solution is to bounce the piece as described in section 2.1.5, which will result in a channel-based version. The other solution is to record all the automation data in Zirkonium version 2 once the piece is completely finished. This can be done automatically and yields an object-based, stand-alone, native Zirkonium version of the piece. We plan to implement this feature in Zirkonium version 3 in the future.

2.4 Binaural Versions

Binaural recordings of Klangdom pieces are maybe only of peripheral interest concerning this paper's topic. Nevertheless we want to mention them as one form in which Klangdom pieces can be distributed. They are of main importance for people without immediate access to a Klangdom environment. Since many researchers and the general public can be included in this group of people, the topic is indeed relevant for our archiving objectives.

3. KEY ELEMENTS OF ARCHIVING AT ZKM | IMA

3.1 Zirkonium

3.1.1 Overview of the software

Zirkonium is a software suite for spatial composition and performance. The development of the software was begun in 2004 and it has been continuously refined until today. In November 2015 the newest version of Zirkonium, version 3.0 was released [6], and version 3.1 is planned to be released in June 2016.

Zirkonium ver. 3.1 consists of three applications. *Trajectory editor*, and two utility applications, *Speaker setup* and *ZirkPad*.

The Trajectory editor (Fig.1) is a standalone Mac OSX software that allows users to compose trajectories of multiple sound objects in time and render them to a dome-like speaker setup consisting of a maximum of 64 speakers. The software features an OpenGL-based superior graphical user interface for trajectory creation, DAW-like spatial event handling tools, and customizable core rendering algorithms.

An accompanying utility software, Speaker Setup, provides users with an OpenGL-based GUI that enables them to define speaker arrangements in a 3D space intuitively. The configuration created by the Speaker Setup application can be stored in either Zirkonium-XML format or SpatDIF-XML format. The Trajectory editor then employs these XML file for initializing its spatial rendering algorithms and visualizing trajectories.

Zirkonium also offers live-performance capabilities. The position of each sound object can be controled by sending OSC messages from an accompanying iPad application, ZirkPad or any other OSC-compatible software. This feature allows users to utilize Zirkonium in a live situation as well.

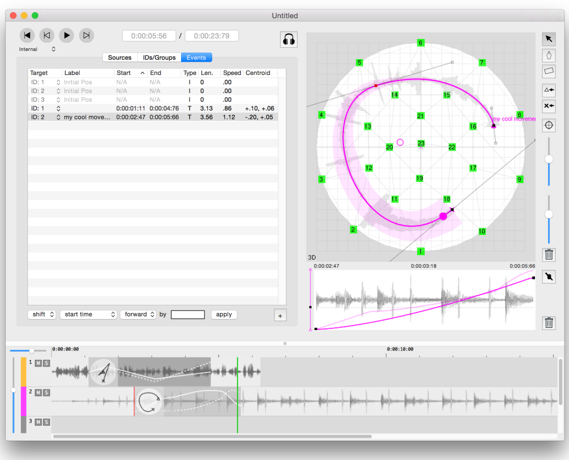

Figure 1. Zirkonium ver. 3.1 Main Window

3.1.2 The data structure of Zirkonium event

In Zirkonium, a spatial composition project consists of multiple spatial *events*. These events are displayed in the manner of a typical DAW software in a timeline view at the bottom of main window (Fig. 1). An event has several attributes, such as target, label, start time, end time, sound path, motion path, span automation, and volume automation (Fig. 2).

Among these attributes, *target* means a sound object or a group of multiple sound objects that is associated to the event. Start and end time define the time frame of the event. The actual trajectory (i.e. the movement of an individual sound object, or a group of sound objects) is described by the combination of two *paths*: Sound path and Motion path. The Sound path defines the geometrical route of a sound object in the listening space, and the motion path defines how a sound object moves in time between the start point (marked with a triangle symbol) and the end point (marked with a cross symbol) of the defined sound path (Fig. 2).

A sound path is stored in the form of a multi segment cubic bezier curve, and the motion path is stored as a multi segment exponential curve. These data for trajectory are rasterized and stored both in the RAM and VRAM each time the user modifies or load a pre-existing file to the Trajectory editor. The rasterized data will be employed for the playback, visualization as well as SpatDIF layer 5 export, described later.

The span automation controls the spread of a sound object (i.e. the diffusion of sound in the listening space) over the time frame of an event, and the volume automation manipulates directly the level of the sound object. These two automations are also described with multi-segement exponential curves.

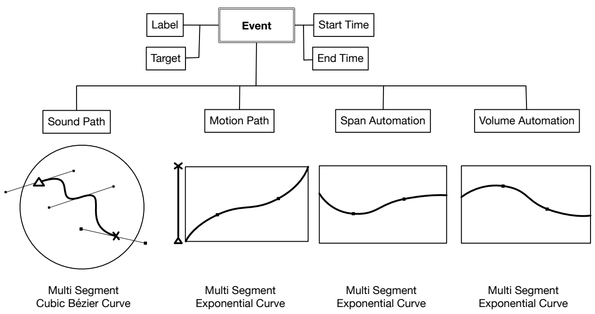

Figure 2. The data structure of an Event in Zirkonium

As briefly disscussed in section 2.1.2, until the release of the Zirkonium version 3.0, a collection of spatial events (i.e. a score of spatial music) was stored only in the file format generated by Apple's core data framework. The core data file can only be loaded by the Zirkonium trajectory editor and does not offer any compatibility to other software. However, Zirkonium ver. 3.0 offers a function to export spatial events using SpatDIF, but the exported SpatDIF data was only available in the form of rasterized descrete data of spatial movements; it was impossible to retrieve the data of Sound path or Span automation from the SpatDIF file.

Zirkonium ver. 3.2, which is planned to be released in September 2016, will be able to store these paths as vectorized data using the most up-to-date version of SpatDIF specification and its C++ library, which will be described in detail in the following section.

3.2 SpatDIF

The Spatial Sound Description Interchange Format SpatDIF is a structured, high-level syntax describing the essential elements of spatial sound scenes that are necessary for their creation and performance. It proposes a simple and extensible format as well as best-practice examples for storing and transmitting information about spatial sound scenes. It is a syntax rather than a programming interface or file-format and can be represented in any of the current or future structured mark-up languages or messaging systems [7].

The human-readable descriptors are structured in a hierarchical fashion, divided into a core category, essential functionalities, and optional extensions. Based on a layered workflow for spatial audio content, elements of such diverse nature as source positions, media playback and patching information from abstract scene to a specific speakers layout are present. This model organizes spatial audio infrastructure and elements in the following layers:

6. authoring – generates scene control data (vectorized)
5. scene description – generates rendering instructions (rasterized)
4. audio stream encoding – actual rendering
3. audio stream decoding – rendering in two-step processes such as Ambisonics
2. hardware abstraction – system audio drivers
1. physical devices – soundcards and speakers

Two principal use-cases can be distinguished:
The first scenario is focusing on storing spatial audio scene descriptions for future playback. This file-based representation contains all relevant scene information within one file, divided into a meta-section with preparatory information and a temporal section with containing the unfolding scene. In addition to the SpatDIF scene description file the actual audio content needs to be stored and maintained alongside it.

The second scenario deals with streamed audio content and scene description information in real-time and quasi real-time. In this network-based representation the scene information is delivered piecewise in time as the scene unfolds and is not guaranteed to provide all necessary setup information in advance. In this scenario contradictory information may arrive that supersedes earlier instructions, and audio content may be streamed alongside the scene information or may be present as sound-file accessible to the rendering software.

The principle of interoperability means that these pieces may originate and be processed by different tools at separate times and places, including future system whose capabilities are yet unknown. The exact nature and technical implementation of these processes should not have to be known or determined at the outset.

A central concept in SpatDIF is the separation of processes of *authoring* and *rendering* of spatial sound scenes or musical pieces such as those in the Zirkonium catalog.

The presence of the *core scene description* (layer 5 information) is essential for generating a *rendering*, i.e., for (re-)producing the piece as musical or sound performance. This representation carries all necessary scene information in its simplest possible form that does not demand complex pre-processing of information in order to obtain actionable rendering parameters. With the addition of simple interpolations, the scene entities' attributes, such as positions or volume changes are described explicitly in sufficient temporal resolution to enable smooth rendering. Every SpatDIF compliant data-set therefore *must* contain such a core scene representation. Even though this essential information depicts a complete scene, it lacks information about the processes and models that led to its creation, from where the author's ideas and intentions could be deduced, recreated or even adjusted.

Therefore version 0.4 of SpatDIF [8] adds descriptors that represent aspects of *authoring* processes (layer 6 information). These processes are typically carried out in an editor such as the Zirkonium Trajectory editor (see Fig. 1) or media programming environments such as MaxMSP, PureData etc. but are also present as automation-data in a DAW's project. This concerns typically the placement and animation of sound sources and describes the developments of temporal, spatial and volume attributes of the entities in the scene (see Fig. 2). Even though this higher-level authoring information is sufficient to recreate a spatial audio piece within the software it was created with, the goal of interoperability and reproduction in future software tools of unknown capability *demands* that the abstract representation, be converted to the simpler core descriptions, i.e., converting the 'vectorized' to 'rasterized' information.

With the addition of authoring descriptors, the SpatDIF data-set contains redundant information in two representations at different levels of abstraction (layer 5 *and* 6).

In such a case, a *rendering* process disregards the authoring information, whereas an *authoring* or editing process that modifies the scene's animation processes supersedes the simpler scene rendering information. In order to maintain the two representations synchronous, when storing the scene, the modifications of the 'blueprint' of the scene in the authoring layer, i.e., of the models and functions that describe the evolution of scene, are always propagated down to the simpler representation. Consequently, the existing rendering instructions are potentially overwritten.

3.3 mediaartbase.de

While Zirkonium offers an interface to the Klangdom and a tool for the spatialization of a composition, SpatDIF guarantees the interoperability and exchangability of the composition. A solution for the storage and systematic description of such media art has long been unavailable. mediaartbase.de seeks to close the gap between the compositional process, the finished production and the presentation of electroacoustic music.

In 2008, four major institutions in the field of media art started the project mediaartbase.de (Fig. 3) [9]. The Institute of Music and Acoustics (IMA) at the ZKM Karlsruhe, the European Media Art Festival Osnabrück, the documenta Archive Kassel and the "Kasseler Dokumentarfilm- und Videofest" came in order to create a platform that suited the need for the preservation and systematic documentation of the miscellaneous works, which have been curated or produced at these institutions. The necessity for such an endeavour was acknowledged by the "Kulturstiftung des Bundes" and therefore financially supported [10]. It was a crucial goal for the design and concept of a prospective database to combine the long-time archiving approach with the availability of the archival objects for the general public. This led to an overall design which separates the (publicly available) presentation sphere from the (long-time) archiving area. Although the appearance as well as the basic structure of the collections from the cooperating partners ("communities") on mediaartbase.de are similar, the structural subdivisions ("collections") of each institution may vary. [1] Therefore the following section focuses only on the strategies, concepts and ideas currently embedded in the archiving process at the IMA. The final report of the project offers further details including the cooperating partners [11].

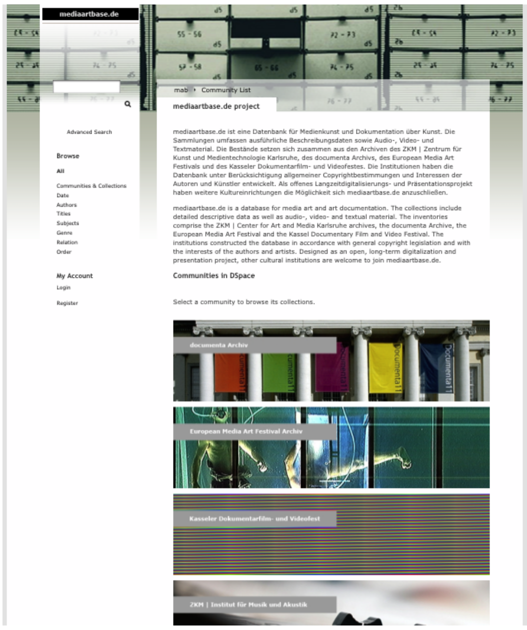

Figure 3. mediaartbase.de website

The adequate description of the work produced at IMA is fundamental for its presentation and archiving. On mediaartbase.de basic information about each production is stored using the Dublin Core Metadata Element Set, which is used by the other institutions in a complementary fashion to extend their own data set, hence guaranteeing a coherent and uniform description for the key information of a piece.

Besides Dublin Core, mediaartbase.de relies on three different metadata registries, which employ the namespace of MARC [12], RDA [13] and MODS [14], enabling the different institutions to enhance the existing metadata design

[1] E.g. the Kasseler Dokumentarfilm- und Videofest decided to create a singular "collection" for every Festival while the IMA chose to structure their collections more broadly ("Audiovisual Productions", "External Musicproductions", "Artists", "Publications" and "Presentations").

Descriptors	Value
dc.title	Title
dc.creator	Author
dc.type	Type [Sound/Video]
dc.type.form	Genre
dc.description	Description
dc.placeoforigin	Country
dc.format.extent	Duration
dc.relation	Catch-all for references to other related items
loc.producer	Producer

Table 1. Shared Descriptors used by all institutions in mediaartbase.de (DC and MARC).

and model,while also offering a shared space for the development and management of the necessary descriptors.

The IMA currently manages six different collections in which productions are arranged by type (audiovisual productions, music productions), while also containing external music productions, publications, events and information about artists. Relationships between different entries in those collections can be established by using the relevant descriptors, allowing the rich and comprehensive history of a single production to be stored as well. [2] This has been made possible by a handle system, that assigns each entry a persistent identifier.

The underlying open source database DSpace not only provides this handle system, but also allows for an easily adjustable rights management [15]. Currently there are two basic options to access the online platform: as registered or unregistered user. The archived material can therefore be displayed either in an unrestricted or restricted manner, based on which rights the artist granted the IMA. Different usergroups can be created and different access permissions may be set up. An IP-based access, allowing the unrestricted display and playback of the archived material within the rooms of the ZKM has been installed in 2015 and offers visitors and employees of the media museum an insight of the various music productions. Due to the separation of archiving and presentation only the metadata and more compressed formats of the stereo versions are available online. The archived originals (multichannel versions, Zirkonium files, uncompressed stereo versions) of the productions are stored locally and held available for both research and performance. However, the technical description (sample rate, bit depth etc.) of the originals are available online and can be accessed, when logged in. The link between the online items and their originals is established through a signature. mediaartbase.de is therefore meant to be a first stepping stone for exploring media art as well as an approach of a systematic overview of the archived material.

The idea of exploring media art systematically is mirrored in the frontend of mediaartbase.de as well. The user is able to browse all collections of a community by categories (“Date”, “Authors”, “Titles” etc.) or to use the search option, that allows for a more refined access to the available database objects. Therefore it becomes a tool for a curious public audience.

On the other hand mediaartbase.de offers access statistics, adaptable submission forms and a supervised system for the submission process that simplifies the workflow and the controlling of the published items. Therefore, mediaartbase.de helps in structuring and systematically recording the archived material as well.

[2] Besides the obvious link between a production and its presentation on a publication or within a concert (dc.relation.ispartof/dc.relation.haspart), further relationships can be modeled. E.g. different version of a piece (dc.relation.isversionof/dc.relation.hasversion).

4. WORKFLOW

Even though nowadays more and more guest artists are using Zirkonium for the productions at IMA, the workflow of the archiving process is still determined by the original idea of recording, storing and describing old fixed media pieces from DAT and HI8 (DTRS) to HDD, thereby saving them from the nearly unavoidable degradation of the medium. But the compositional and technical process in the production of electronic music has moved on. It seems that the problem of different versions of a musical piece has grown with the possibility of the composer making changes very simply using only his personal computer rather than a whole studio. This also led to a more reluctant position of composers towards the archiving of their piece, since this is often perceived as a final commitment on behalf of the composer. However, many composers are still interested to see their work archived and presented in an appropriate manner.

Another important change regarding the archived work is that while fixed media pieces from DAT and DTRS are bounced to several mono-channel files resulting in the finished production of a composer, the Zirkonium pieces only consist of the input files together with the respective Zirkonium-file, describing the spatialization process. Even though, as mentioned above, it is possible to bounce the finished work to several mono-channel files in Zirkonium as well, this would lead to unnecessary redundancies. Since the Zirkonium-project of a composer can be understood as a sort of musical score, it may contain valuable information for researchers and therefore should be stored. It is important to remember, that the pieces created with Zirkonium are not bound to the maximum of loudspeakers in the described Klangdom. Therefore, a bounced version can only be a momentary record of the work of a composer. Furthermore, the newly added descriptors in SpatDIF 0.4 maintain the abstract representation of musical score, while increasing the compatibility of data. It is a clear advantage of SpatDIF compared to other specifications such as ADM [16]. Though most of the major institutes of electro-acoustic music employ the channel-based archiving approach, we adopted the new object-based approach because it greatly contributes to our three objectives: preservation, application, and accessibility.

Based on the experience with the first version of Zirkonium, the second version introduced major changes, which made the composition and the performance of the produced work more comfortable. Currently, the backward compatibility of Zirkonium ver. 3.2 is being implemented. IMA has to retain and maintain the first version until a sufficient number of tests are performed. This generates additional work in the documentation process of spatial music, but also affected the performance of these works, since the performance hardware in the Klangdom needed to support both versions as well as the barrier-free switching between them. Having learned from this situation, the decision to rely on a file-format that doesn't depend on a software and its versioning history proved to be almost unavoidable.

Since the early Zirkonium file format is based on xml (zrkpxml) the retrieval of basic information is possible, but, due to the fact that binary information (e. g. color information) was stored as well, the human readability suffered from this. The ensured design and maintaining of the specifications of a file format for performance and archiving purposes require to address exactly these points. Currently, archiving at IMA comprises multiple steps. After the composition process, a guest artist at ZKM usually hands his produced work over to the IMA archive. Based on a questionaire given to the artist, the relevant information about the piece and a work abstract is added to mediaartbase.de. A stereo version provided by the composer is also used for the presentation of the piece as well as additional files such as image material or scores. Within an archive-contract the composer has the possibility to exactly determine how accessible his work should be and whether a full stereo version is available or only a short sample of it. It is our aim to make this process as easy and unbureaucratic as possible. Besides other measures, using SpatDIF as a source for information can help making the information retrieval process more transparent and less complicated. A file format which contains the important information in one clearly documented way is the next step in order to reach this goal and to ensure the further cooperation of the composers.

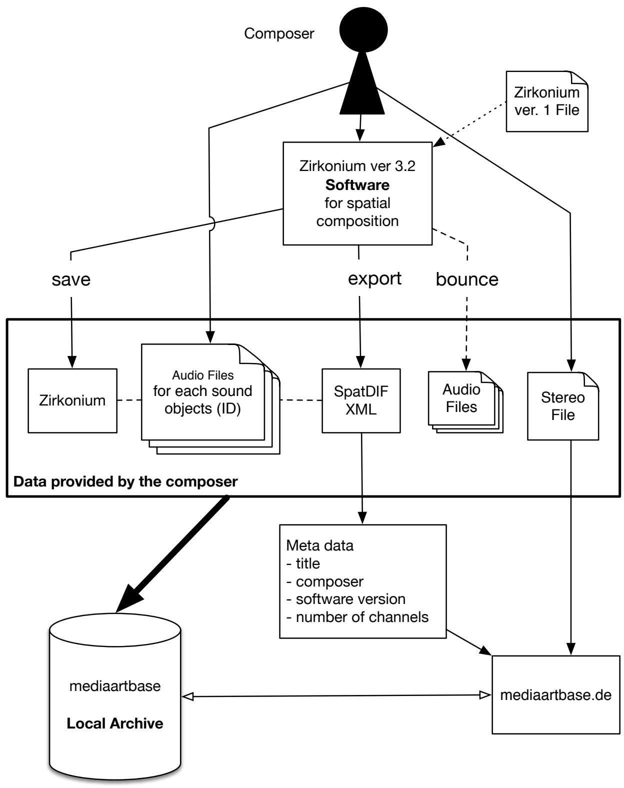

Figure 4. The workflow of archiving at ZKM

5. CONCLUSIONS

Preservation, application, and accessibility are three primary objectives of spatial music archiving at IMA. In order to achieve these objectives, the IMA deploys three key elements: Zirkonium, SpatDIF, and mediaaartbase.de.

The newest version of Zirkonium contributes to reaching these objectives by making spatial compositions available in a wide range of formats; it allows users to export a piece to simple channel-based audio files together with a more flexible SpatDIF 0.4 compliant spatial score.

The use of SpatDIF for storing Zirkonium pieces in the mediaartbase.de represents one of the central use-cases this standard was developed for. At the same time, it provides an ideal test-case for validating that the newly defined authoring layer descriptors are capable of properly representing the high-level information of a real-life trajectory editor.

It should be evident that a file format, which is future-proof, human-readable and independent from specific platforms or applications is imperative for the archiving process at IMA. Since the aim of mediaartbase.de is not only to store and preserve the archived media, but also to make it available and accessible for research and performance, a format which considers these different and sometimes conflicting demands is hard to find. The SpatDIF format can be integrated easily within our archiving workflow and therefore perfectly complements and supports our endeavor for a coherent, cohesive, and systematic production archive.

Acknowledgments

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